AMENDED SPECIFICATION.

F21

Reprinted as amended under Section 8 of the Patents and Designs Acts, 1907 to 1932.

PATENT SPECIFICATION

Application Date: Dec. 2, 1931. No. 33,387/31. 393,935

Complete Left: Oct. 3, 1932.

Complete Accepted: June 2, 1933.

PROVISIONAL SPECIFICATION.

Improvements relating to the Storage and Preservation of Meat.

I, FERNAND NIERINCK, a Belgian subject, of Chelmer Park House, Riverside, Chelmsford, do hereby declare the nature of this invention to be as follows:—

This invention relates to the preservation of slaughtered meat for human consumption and is especially applicable to those forms of meat, e.g. beef, which if frozen show serious deterioration when subsequently thawed out, retailed and cooked.

It has been found that beef is very much injured by freezing, the juice flowing from the meat when it is thawed and the quality after cooking suffering from being tasteless and dry. This deterioration is so serious that frozen beef has come to be regarded as a low grade article of commerce.

At present the best method of storage and transport of beef in bulk is by cold storage as chilled beef in vessels maintained at or near the freezing point, i.e. about −1.5 to −1.8 degrees Centigrade. It is well recognised that chilled beef is a highly perishable article of commerce such that the time of storage from killing to consumption must commercially be limited to about 42 days when preservation by chilling is utilised. This it will be seen is adequate for transport from countries such as the Argentine Republic but only allows even then for a short time for storage on arrival and before marketing such as is frequently a source of difficulty and loss. The depreciation of chilled beef is mainly due to mould and bacterial growth, and at present is also in part due to local freezing which takes place under practical conditions of cold storage by chilling.

It has now been found that beef can be preserved for long periods enabling transport from distant countries such as New Zealand and Australia at temperatures high enough to prevent the risk of local freezing provided the storage is effected in an inert atmosphere under suitable controlled conditions, and further that mould and bacterial growths can be prevented notwithstanding the higher temperature utilised.

It has also been found practically that when by the inert atmosphere employed mould growth is checked or prevented then in fact bacterial growth practically does not take place.

By "inert atmosphere" as used herein I mean a gaseous atmosphere of low oxygen tension not directly reactive chemically with the tissues or affecting their flavour although capable of sterilising, i.e., destroying or inhibiting the growth of bacteria and moulds.

Experience also shows that although higher humidity may prevail in the storage chamber under the ice free conditions yet this is not harmful seeing that mould growth and the like is prevented by the suitably conditioned gaseous atmosphere.

The invention consists broadly in preserving perishable tissues, e.g., beef, mutton, bacon, fowls, game or the like, for human consumption at a suitable temperature in a sterilising atmosphere of low oxygen content preferably containing less than about 4 per cent. of oxygen.

The invention further consists in effecting the preservation in an atmosphere of low oxygen content containing carbon dioxide gas as the sterilising agent preferably maintained at a suitable low temperature.

The invention also consists in a process for storing meats such as beef comprising placing the same when slaughtered and prepared in vessels or holds or chambers suitable or adapted for the more or less complete replacement of their air and other elastic fluid contents by a medium of low oxygen content, preferably below 4 per cent., maintained near the freezing point but preferably above that at which

[Price 1/- Price 4s 6d

local freezing can take place and preferably at a slight pressure above atmosphere.

The invention also consists in effecting the replacement by suitable means, pumps, fans or the like, adapted to displace the elastic fluid contents of the chamber and replace same by inert gas, e.g. CO_2 or mixtures of CO_2 and nitrogen.

The invention also consists in displacement of the elastic fluid contents by the gas or gaseous mixture entering the chamber under pressure as discharged from cylinders, vaporising solid CO_2, and the like.

The invention further consists in providing for the replacement from time to time or continuously of part of the elastic fluid contents by fresh inert gas or gas freshened by the removal therefrom of air or oxygen together with any elastic fluid emanations from the carcases.

In carrying the invention into effect in one form by way of example as applied to the storage, transport and preservation of beef from a distant source, e.g. Argentine or Australia, by the aid of carbon dioxide gas, I utilise storage chambers such as are at present used for the storage and transport of beef in chilled condition made gas tight in a suitable manner, but I provide inlet passages into such closed chambers through which the gas can be introduced and outlet passages therefrom for discharge of the displaced vapours and air, and I provide appliances such as pumps or fans connected with these chambers in such a way that the elastic fluid contents of the chamber can be displaced fairly rapidly with only a very small rise in pressure within the chamber, say two to six inches of water column, enough to ensure that any leaks will take place outwardly and thus prevent the ingress of air.

I connect the outlet passage of the chamber at the top thereof with a pipe leading to an absorption apparatus containing an oxygen absorbing material, say pyrogallol, or to an oxygen combustion chamber, and lead a gaseous outlet therefrom back to the delivery passage into the chamber.

The anhydrous carbon dioxide gas may be supplied from compressed CO_2 in cylinders, or may be produced by a generating apparatus, or again may be derived from vaporising solid CO_2 now known as " dry ice ".

In some cases it is not necessary to use carbon dioxide alone but mixtures of carbon dioxide and nitrogen or such as may be obtained by absorbing the oxygen from ordinary air, or products of combustion may be used.

For the preservation of beef, I maintain the storage space at a low oxygen content, preferably about or below 2 per cent., and containing preferably carbon dioxide as the main constituent, say 95 per cent.

By the present invention the time of storage can be readily extended and the meat preserved in condition approximating closely to the home killed meat, retaining its flavour and giving no drip.

Although described in reference to the preservation of beef the process herein described may be applied to the preservation of other perishable tissues utilised for human consumption, e.g. mutton, bacon, fowls or game.

Dated this 1st day of December, 1931.

MARKS & CLERK.

COMPLETE SPECIFICATION (AMENDED).

Improvements relating to the Storage and Preservation of Meat.

I, FERNAND NIERINCK, a Belgian subject, of Chelmer Park House, Riverside, Chelmsford, in the County of Essex, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the preservation of slaughtered beef for human consumption, the preservation of animal tissues other than beef being dealt with in my Application No. 27,453/32 (Serial No. 393,663) of even date herewith.

It has been found that beef is very much injured by freezing, the juice flowing from the meat when it is thawed, and the quality after cooking suffering from being tasteless and dry. This deterioration is so serious that frozen beef has come to be regarded as a low grade article of commerce.

It has also been found that beef if frozen shows serious deterioration when subsequently thawed out, retailed and cooked.

At present the method most largely used in practice for the storage and transport of beef in bulk is by cold storage as chilled beef in chambers maintained at or near the freezing point of beef, i.e., " ice free " beef is stored at 30° to 32° F. and

"commercial chilled" beef is stored at 28° to 30° F. It is well recognised that chilled beef is a highly perishable article of commerce, such that the time of storage from killing to consumption must commercially be limited to about 42 days when preservation by chilling is utilised. This is adequate for transport from countries such as the Argentine Republic, but only allows even then for a short time for storage on arrival and before marketing, such as is frequently a source of difficulty and loss. The depreciation of chilled beef is mainly due to mould and bacterial growth, and at present is also in part due to local freezing which takes place under practical conditions of cold storage by chilling.

In an earlier Patent No. 318,534, I have described a method for the preservation of eggs in shell which, as I have pointed out in my prior specification, may be applied to the preservation of fruit, vegetables, meat, fish or the like. This is based on the idea of making use of an autoclave, so that I could employ egg-containers of light construction as, although in this method I use a process of air evacuation, the same pressure was established inside and outside the container. This was effected by housing the container in an autoclave, evacuating the air from the autoclave and the container, and thereafter simultaneously filling the autoclave with air and the container with gas at substantially balanced pressures. The container was then moved into a storage chamber kept at the required temperature.

In a co-pending Patent Application No. 35,796/31 (Serial No. 391,256) (claiming the priority of Danish Application dated 19th March 1931), I have described a method of preservation of eggs in shell in which the eggs are placed in an autoclave, the air is evacuated and then CO_2 gas or a mixture of CO_2 and nitrogen is introduced into the autoclave. The eggs are subsequently taken out of the autoclave and stacked into gas-tight cooled stores. The atmosphere in the stores is then altered to have low oxygen content and a high percentage of CO_2 or CO_2 and nitrogen, the change of the composition of the storage atmosphere being effected by displacement, i.e. gas being admitted to the storage chamber at the same rate as air is being withdrawn from said chamber. Means for passing the storage atmosphere through an oxygen-absorbing medium are incorporated, also means to subject the storage atmosphere to a process of liquefaction whereby the desired and undesired constituents of the storage atmosphere may be separated.

According to the present invention the foodstuff to be preserved, i.e. beef, is not first passed through an autoclave or evacuation chamber as in my previous patent and application mentioned above. In the case of eggs in shell it has been found necessary to remove the oxygen containing air held in the air-space of the eggs, and held in suspension in the liquid contents of the eggs, whereas in the case of animal tissues such as beef, no air or only a very minute amount is held in the tissues.

The object of the present invention is to provide an improved or modified process directed to the special problem of the storage of beef, especially from the point of view of enabling preservation of beef to be obtained over long periods without undue deterioration, and directed more particularly to the preservation of large bodies or quantities of beef, such as are required in the transport of slaughtered beef for human consumption.

It has now been found that beef can be preserved for long periods, of the order occurring in transport from distant countries, such as New Zealand and Australia to England at temperatures high enough to prevent the risk of local freezing provided the storage is effected in a suitably inert or sterilising gaseous atmosphere under suitable controlled conditions, and further, that mould and bacterial growths can be prevented, notwithstanding the higher temperature utilised.

Experience also shows that although higher humidity may prevail in the storage chamber under the higher temperature conditions, yet this is not harmful, seeing that mould growth and the like is prevented by the suitably conditioned gaseous atmosphere.

It is well known that certain bacteria adapt themselves to new environment, and bacterial growth may therefore after a time develop more rapidly than when at first subjected to the inert atmosphere.

I have found that the displacement of the storage atmosphere by, say, pure nitrogen, or fresh air previously cooled, carried out from time to time for short periods in the case of long-period storage of beef counteracts the adaptation referred to above.

The invention consists in a single stage method of preserving beef for human consumption in a gaseous atmosphere at a suitable temperature which comprises simultaneously withdrawing or displacing air from a beef storage chamber, and replacing it by a preserving gas which remains at substantially atmospheric pres-

sure in the chamber and consists in carbon dioxide or a mixture of carbon dioxide and nitrogen, so that the resulting preservation atmosphere surrounding the aforesaid beef contains more carbon dioxide than oxygen, the remainder of the atmosphere consisting substantially of nitrogen.

The invention also consists in a process according to the preceding paragraph which consists in providing for the replacement from time to time or continuously of part of the elastic fluid contents of the storage chamber by fresh preserving gas or gas freshioned by the removal therefrom of part of its constituents, for example, oxygen or emanations from the carcases.

The invention also consists in a process according to either of the preceding paragraphs which consists in providing for the replacement from time to time for a short period of time of part or of the whole of the gaseous atmosphere of the storage chamber by pure nitrogen or by fresh air.

The invention also consists in processes for preserving beef based on the processes of the preceding paragraphs, substantially as herein described, and in beef when preserved by the processes particularly described and ascertained herein.

In carrying the invention into effect in one form by way of example, as applied to the storage, transport and preservation of beef from a distant source, e.g., Argentine or Australia to England, or long trans-Continental transport, by the aid of an inert atmosphere, I utilise storage chambers such as are at present used for the storage and transport of beef in chilled condition, but made gas-tight in a suitable manner, and I provide inlet passages into such closed chambers through which the gas can be introduced, and outlet passages therefrom for discharge of the displaced vapours and air, and I provide appliances such as pumps or fans connected with these chambers in such a way that the elastic fluid contents of the chamber can, when required, be displaced fairly rapidly with only a very small rise in pressure within the chamber, say two to six inches of water column, enough to ensure that any leaks will take place outwardly, and thus prevent the ingress of air.

When required I connect the outlet passage of the chamber with a pipe leading, for instance, from the top of the chamber to an absorption apparatus containing an oxygen absorbing material, say pyrogallol, or to an oxygen combustion chamber, and lead a gaseous outlet therefrom back to the delivery passage into the chamber, which is preferably at the lowest point.

The inert atmosphere consists of a mixture of gases as above defined and I have found that good results are obtained in a storage atmosphere cointaining about 10% oxygen, about 30 to 50% CO_2 and the remaining parts nitrogen, in the case of long storage of beef, whilst a higher percentage of oxygen, e.g., about 17% and a smaller percentage of CO_2, e.g. 20%, have been found to give good results during a period of storage of about 10 days, at a suitable temperature, say 30° F. to 34° F..

Apart from the composition of the inert atmosphere having an inhibitive effect on mould and bacterial development, it also influences the retention of colour of the lean and fat of the meat. Whereas an atmosphere of above composition appears also to retain the colour of beef in general, with which this Application deals, it is interesting to note, for the purposes of comparison, that a higher percentage of carbon dioxide appears to be more suitable for the preservation of pork, the preservation of which meat is not a part of the present invention. It may therefore be assumed that the most suitable composition of the storage atmosphere is preferably varied according to the age, breed, etc., of the animal from which the beef is derived. The atmosphere-composition stated gives the order of the average percentages of the constituents.

Obtaining storage atmospheres of the above composition is a simple matter. Pure air normally contains 20.93 oxygen, 0.03 CO_2 and 79.04 nitrogen. By introducing CO_2 gas or a mixture of CO_2 and nitrogen at a slow rate near the floor of the storage chamber and removing the air from the top of the chamber at the same rate, or letting the air escape at the top through a suitably sized aperture, it has been found that little or no diffusion of incoming gas and air in the chamber takes place. When enough gas has been introduced the atmosphere inside the chamber is circulated for a short time, say about 10 minutes, by a fan or air pump to ensure good mixing of air and gas.

Thus, if per 100 litres volume of storage air 50 litres of a mixture of 60% CO_2 and 40% nitrogen are introduced, the resulting atmosphere will contain 10% oxygen, 30% CO_2 and 60% nitrogen.

If per 100 litres storage air volume 50 litres of CO_2 gas are introduced, the resulting atmosphere will contain 10% oxygen, 50% CO_2 and 40% nitrogen.

If per 100 litres storage air volume 35 litres of CO_2 gas are introduced, the resulting atmosphere will contain 13%

oxygen, 35% CO_2 and 52% nitrogen.

The anhydrous carbon dioxide gas may be supplied from compressed or liquid CO_2 in cylinders, or may be produced by a generating apparatus, or again may be derived from vaporising solid CO_2 now often known as " dry ice ".

Mixtures of carbon dioxide and nitrogen such as products of combustion, or as obtained by absorbing the oxygen from the air, may be used.

GENERAL.

By " inert atmosphere " as used herein I mean a gaseous atmosphere of low oxygen content not directly reactive chemically with the beef tissues or affecting their flavour, although capable of suitably sterilising, i.e., from the point of view of destroying or retarding or inhibiting the growth of moulds and bacteria.

By the present invention, the time of safe storage can be greatly extended, and the meat preserved in condition approximating closely to the home killed meat, retaining its flavour and giving no drip, the keeping qualities appearing to be better than those of chilled meat.

No claim is made to the known method of preserving foodstuffs (see the claims of Specification No. 391,256), comprising three stages as follows:—First subjecting the foodstuffs to a vacuum, following this by a treatment with inert gas (carbon dioxide and nitrogen) under pressure to replace the air removed from them, and thirdly removing them from the chamber in which the treatment has been effected to a storage chamber filled with inert gas in which the inert atmosphere is formed by simultaneously removing air and admitting inert gas, until the proportion of oxygen has been very considerably reduced.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that subject to the above disclaimer, what I claim is:—

1. A single stage method of preserving beef for human consumption in a gaseous atmosphere at a suitable temperature which comprises simultaneoulsy withdrawing or displacing air from a beef storage chamber and replacing it by a preserving gas which remains at substantially atmospheric pressure in the chamber and consists in carbon dioxide or a mixture of carbon dioxide and nitrogen so that the resulting preservation atmosphere surrounding the aforesaid beef contains more carbon dioxide than oxygen, the remainder of the atmosphere consisting substantially of nitrogen.

2. A process as claimed in Claim 1 in which the preservation atmosphere consists substantially of oxygen, carbon dioxide and nitrogen, the oxygen content being about 10—17% and the carbon dioxide content about 20—50%.

3. A process as claimed in either of the above claims, which consists in providing for the replacement from time to time or continuously of part of the elastic fluid contents of the storage chamber by fresh preserving gas or gas freshened by the removal therefrom of part of its constituents, for example, oxygen or emanations from the carcases.

4. A process as claimed in any of the above claims, which consists in providing for the replacement from time to time for a short period of time of part or of the whole of the gaseous atmosphere of the storage chamber by pure nitrogen or by fresh air.

5. A process for the preservation of beef substantially as herein described.

6. Beef when preserved by the processes particularly described and ascertained herein.

Dated this 3rd day of October, 1932.

MARKS & CLERK.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1934.